
Off-Farm Investment of Farm Households: A Logit Analysis

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Abstract

This investigation considers factors affecting off-farm investment of farm households. A national farm-level survey was used to evaluate the effects of various farm and operator characteristics on the likelihood of off-farm investment. Results suggest differences in level of education, age of the operator, off-farm income, household net worth, leverage, farm size, farm diversification, management skills, and location influence off-farm investment decisions.

Key words: farm household, logit analysis, off-farm investment

Risks are widespread in agriculture. Unexpected climatic, biological, economic, and political events pose hazards to the continued viability of farm and ranch businesses. In general, there are three types of risk faced by farmers: (a) production and marketing risk, (b) financial risk, and (c) price risk (Barry).

Identifying the sources of risk aids in the choice of appropriate adaptive management strategies. Responses to marketing risk include inventory management and forward and future contracts. Participation in government programs may be a response to production or marketing risks, or both, depending on the program. Financial responses to risk reflect the firm's capacity to bear risks in production and marketing, and mostly involve the management of leverage and liquidity.

Other responses may focus on transferring the risks outside the business—such as hedging, forward or futures contracts for commodities or farm inputs. Further, responses to risk have involved reducing risks within the business—such as effective diversification of several types of assets, crop insurance, organization flexibility, avoidance of high-risk enterprises, and holding liquid reserves of cash and credit.

Yet another strategy, one that has not received much attention, is investing in nonfarm financial assets. By holding a portfolio of farm and nonfarm assets, farm households can diversify risk. Lins and Hofing point out that farm managers spend less time studying off-farm investments than investments on the farm.

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However, the 1995 "Survey of Consumer Finance" (SCF), conducted by the Federal Reserve System, shows that off-farm investment by farm households in various forms (such as stocks, bonds, CDs, mutual funds) has increased in recent years. The average farm household possesses both liquid and fixed assets, with fixed assets occupying a larger share (almost 90%) of the total. The most important asset of the farm business is land,¹ which constitutes more than 70% of the total value of farm assets (Monke). Other assets include farm machinery (tractors, combines, and other implements), land improvements, buildings, and livestock.

Table 1 reports financial characteristics of U.S. farm families for 1992 and 1995, based on SCF survey data for these years. The total assets of an average household increased from \$741,652 in 1992, to \$854,945² in 1995, or 15% in nominal terms. The debt level (total liability) for an average farm household increased slightly from \$50,737 in 1992, to \$56,875 in 1995 (a 12% increase). However, with rising asset values, the debt-to-asset ratio between the two years has remained approximately unchanged.

As seen from the data in Table 1, liquid assets of the average farm household consist primarily of checking and savings deposits. Total financial assets of an average farm household increased from \$104,272 to \$157,755, a 51% increase between 1992 and 1995.³ These data also indicate that more money in 1995 was invested in stocks, bonds, and individual retirement accounts (IRAs) than in 1992. Moreover, there was a significant increase in the amount saved in the form of CDs and mutual funds. Average nonfinancial

assets of farm households increased by only 9%—up from \$637,380 in 1992, to \$697,191 in 1995.

The deregulation of U.S. financial markets (such as branch banking, interstate banking, and selling mutual funds by banks) has afforded individuals and farmers additional investment opportunities (Kold and Rodriguez). Further, recent changes in the Taxpayer Relief Act of 1997 offer new opportunities at a time when farmers have several motives for diversifying total assets beyond the farm (Mishra and Morehart).

Investments selected by individual farmers/farm households will have important implications for their financial well-being, the availability of venture capital for economic development of rural areas, and the competitiveness of financial institutions in rural areas. Furthermore, farmers/managers need to carefully consider their investment (both farm and off-farm) portfolios because many of their financial decisions have ramifications for liquidity, retirement, solvency, taxation, and profitability management. Despite the importance of such information, little is known about the farm operator's household and socioeconomic characteristics that affect off-farm investments.

Given the importance of off-farm investment, identifying what factors are associated with farms that have these types of investments will make several significant contributions to the literature:

- It can be determined if there are limiting characteristics to this type of risk management activity—such as education, age, the amount of wealth accumulated in land, and other important characteristics.
- The whole issue of retirement planning and the life cycle behavior of farmers will be influenced by a better understanding of whether or not land (or potential capital gains on its sale) is the primary retirement holding of farmers.

¹ For many small farms with gross sales of \$250,000 or less, farm dwelling contributes 15% or more to the total farm assets (Hoppe).

² It should be pointed out that farm business, in the category of nonfinancial assets, had the largest share. Farm business is defined as net equity if the business were sold today plus value of personal assets used as collateral for a business loan.

³ During the same period (1992–1995), share of off-farm assets in total assets increased from 14% to 18%.

Table 1. Financial Characteristics of Farm Families in the U.S., 1992 and 1995

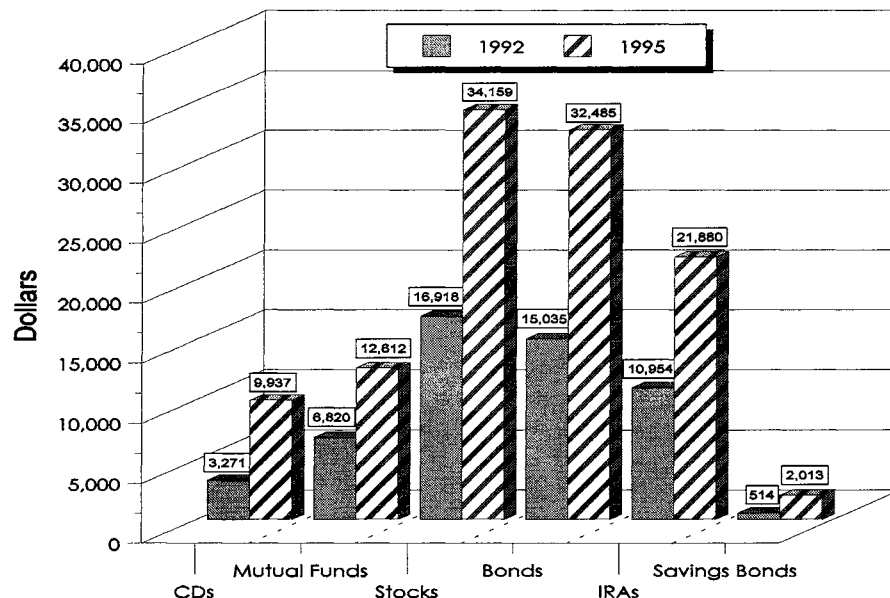
Description	1992	1995
Number of Farm Households Surveyed	368	423
Average Number of Farm Acres	275	265
Average Hours Worked per Week on the Farm	44	46
Average Gross Farm Sales (\$)	68,097	74,453
Average Net Farm Income (\$)	23,022	17,015
Average Total Assets (\$)	741,652	854,945
Average Total Financial Assets (\$):	104,272	157,755
Checking and Savings Accounts	27,063	18,531
CDs	3,271	9,937
Mutual Funds	6,820	12,612
Stocks	16,918	34,159
Bonds	15,035	32,485
IRAs	10,954	21,880
Savings Bonds	514	2,013
Cash Value of Life Insurance	8,303	9,195
Other Financial Assets	15,392	16,941
Average Nonfinancial Assets (\$):	637,380	697,191
Vehicles	18,273	17,316
Dwelling	98,522	58,348
Farm Business	441,888	512,035
Other	4,834	4,092
Average Total Liabilities (\$):	50,737	56,875
Housing Debt	35,150	25,644
Other Lines of Credit	34	2,719
Other Real Estate Debt	9,153	21,253
Credit Cards	1,347	556
Installment Loans	3,669	6,057
Other Debt	1,385	645
Average Net Worth (\$)	690,915	798,070
Debt-to-Asset Ratio (%)	0.068	0.066

Source: Calculated from the 1992 and 1995 "Survey of Consumer Finance," Federal Reserve System. (The data in these surveys are generally collected for the preceding year.)

- The vulnerability of farm businesses and farm households to changes in the general economy versus changes in agricultural prices (both inputs and outputs) will be influenced by the degree to which the farm business and farm household are diversified.
- A better understanding of the economics of farms can be achieved

by identifying the impact of off-farm investment on the financial success of the farm business and household income.

Based on the above considerations, the objectives of this study are to identify factors that affect off-farm investments by farm households, and to quantify their relative importance in off-farm investment decisions by farm households.



Source: 1992 and 1995 "Survey of Consumer Finance," Federal Reserve System.

Figure 1. Average Off-Farm Investments of Farm Households

Background

The farm household maximizes expected utility by allocating initial wealth among competing investment alternatives. Farm households can invest in on-farm assets such as land, machinery, and farm equipment, and off-farm assets (mostly financial assets) such as stocks, bonds, IRAs, CDs, and mutual funds. Figure 1 illustrates the average off-farm investments of farm households as reported by the "Survey of Consumer Finance" for 1992 and 1995 (Federal Reserve System).

Penson notes that investment in financial assets is an attractive means of diversification for many farmers. In their investigation of returns to agricultural and nonagricultural assets, Bjornson and Innes found that owners of agricultural assets have less diversified investment portfolios because farm assets are less correlated with systematic risks. They conclude that farmer-held assets tend to

earn lower returns than comparable-risk nonagricultural assets. Based on Weldon's analysis of farm risk and diversification, investors who hold a large proportion of their portfolio in residential real estate or agricultural assets in general can greatly reduce their overall risk by diversification with other assets such as stocks and bonds. Robison and Barry show that new financial assets will substitute for each other if the covariance between asset returns is positive. Furthermore, asset diversification will continue to increase if either wealth⁴ or risk aversion increases (Cass and Stiglitz).

⁴In his seminal work, Arrow shows, with two assets (one risky and the other risk free), that under increasing relative risk aversion an increase in initial wealth decreases the proportion of risky assets in total wealth and increases the proportion of safe assets. Additionally, Takayama reports that under decreasing absolute risk aversion (DARA) an increase in wealth leads to an increase in risky assets. Cass and Stiglitz, using more than one risky asset in the portfolio, conclude that with increasing relative risk aversion an increase in initial wealth increases the share of risky assets in the portfolio.

Off-farm investment has received little attention in the farm household literature. However, research has focused on efficient portfolios that generate the largest expected return for a given level of risk (Monke, Boehlje, and Pederson). Other researchers have analyzed various aspects of farm and nonfarm asset investment (e.g., Young and Barry; Irwin, Forster, and Sherrick; Moss, Featherstone, and Baker; Crisostomo and Featherstone; Weldon). Overall, these studies conclude that off-farm financial diversification reduces exposure to risk. They also suggest that adding financial assets with higher levels of risk, but also higher expected returns, can reduce overall risk associated with farm investments.

Results of an analysis conducted by Schnitkey and Lee indicated that stocks and bonds reduced variability in farmland returns more effectively than Treasury bills, and a risk-efficient portfolio should not have more than 50% of its value invested in farmland.

While the literature provides the theoretical framework for risk-efficient portfolios, there has been limited research focusing on factors affecting investment in off-farm assets or type of off-farm investments. LaDue, Miller, and Kwiatkowski, in a survey of New York producers, found gross income and age had a positive and negative significant effect, respectively, on farm reinvestments. However, it should be noted that their study did not consider off-farm investments by the producers.

In another study (the first of its kind), Gustafson and Chama identified the types of financial assets held by North Dakota farmers. They found that most respondents invested in liquid, low-risk financial assets such as savings and checking accounts and certificates of deposit. In addition, approximately 31% of producers held investments in mutual funds, common stocks, and bonds.

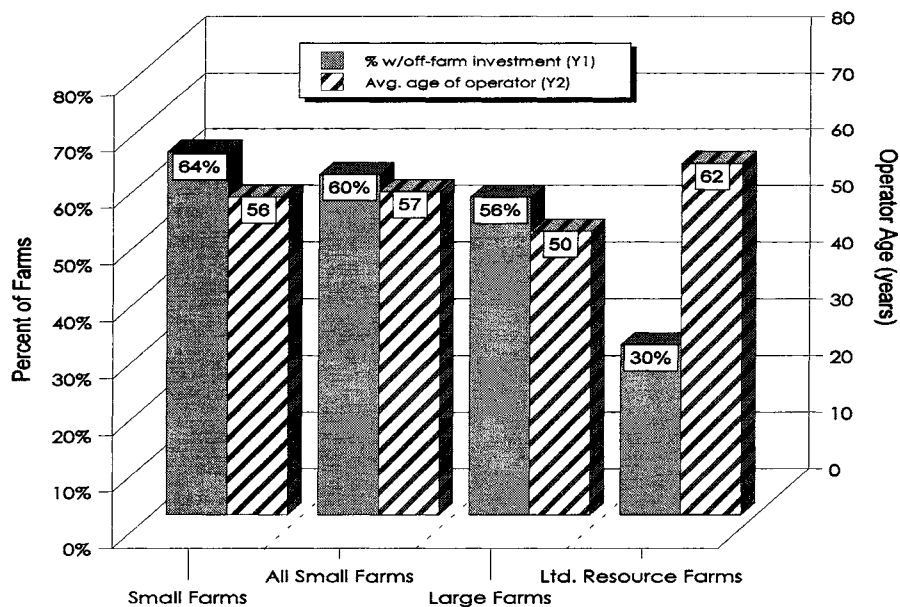
American farms vary widely in size and other characteristics, ranging from very

small limited resource farms to very large family and corporate farms. Taking this diversity into consideration, the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) in 1998 developed a farm typology that categorizes farms into more homogeneous groups. The typology identifies five groups of small farms⁵ (annual sales less than \$250,000): limited resource, retirement, residential/lifestyle, farming occupation/low sales, and farming occupation/high sales. To cover the remaining farms, the typology identifies large family farms, very large family farms, and nonfamily farms (see Hoppe).

Off-farm investments vary by farm size and type. Data from the USDA's 1996 "Agricultural Resource Management Study" (ARMS) survey show that, in general, 60% of all small farms (annual sales less than \$250,000) reported some off-farm investment. The operators of these farms tend to be older and carry lower debt loads (debt-to-asset ratio). Further, 65% of small farms whose operators identified farming as their main occupation (both low and high sales small farms) reported having some off-farm investment (see Figure 2). In contrast, only 57% of large and very large farms (whose operators tend to be younger) reported having off-farm investments.

One possible explanation for the greater likelihood of small farms to have off-farm investments is that small farm households have off-farm income and are therefore likely to have investments related to that work (such as profit sharing and 401K plans). As might be expected, limited resource farms (i.e., gross sales under \$100,000, farm assets under \$150,000, and farm household income under \$20,000) are least likely to have off-farm investments. These farms have an average operator age of 62 and hold very little debt (approximately 8% debt-to-asset ratio),

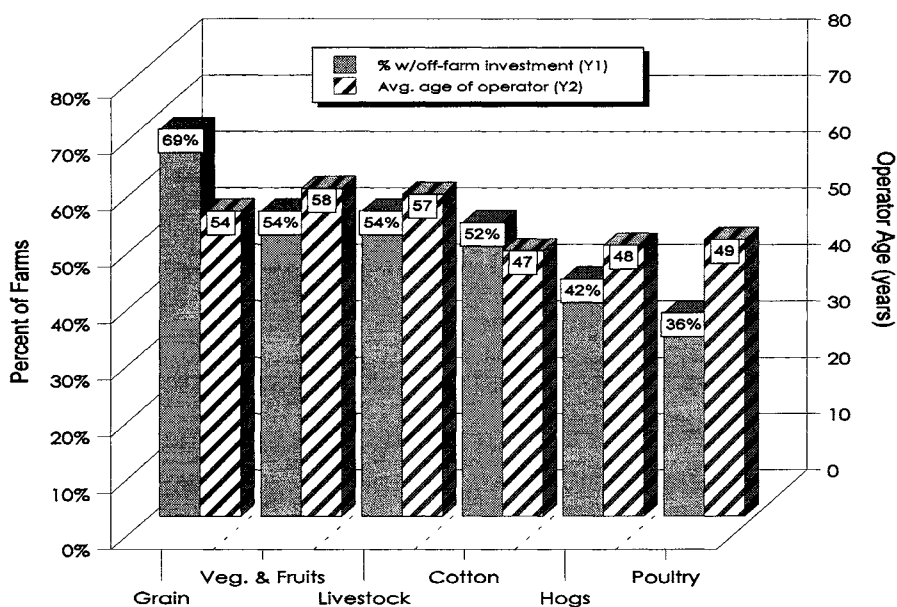
⁵ A recent report by the National Commission on Small Farms (USDA) defines small farms as farms having gross annual sales of less than \$250,000.



Source: 1996 "Agricultural Resource Management Study" (ARMS), USDA.

Note: Small farms and farms with farming as their main occupation are more likely to have off-farm investments.

Figure 2. Off-Farm Investment by Farm Size and Operator Age



Source: 1996 "Agricultural Resource Management Study" (ARMS), USDA.

Note: Cash grain, livestock, and vegetable/fruit farmers are older and are more likely to have off-farm investments.

Figure 3. Off-Farm Investment by Farm Type and Operator Age

but resource levels limit their capability to acquire off-farm investments.

Another way to examine farmers' holding of off-farm investments is to differentiate by the major commodities they produce (as illustrated by the graph in Figure 3). Cash grain farm operators were most likely to report off-farm investments, at 69%. The next highest, with 54% having off-farm investments, were both vegetable and fruit, and livestock producers. Figure 3 reveals that operators of cash grain, vegetable and fruit, and livestock farms are older, and these farms have lower debt-to-asset ratios compared to cotton, hog, and poultry farms. It should be pointed out that the percentages of hog and poultry farms reporting off-farm investment are considerably lower than for other types of farms. One possible explanation could be the presence of contracting and higher amounts of debt.

Conceptual Model

Suppose that a farmer (or head of household) is considering whether to invest funds in nonagricultural opportunities (off-farm investments), such as common stocks, bonds, CDs, and money market instruments. Farmers will treat an off-farm investment as any other investment. A farmer will compare the net present value (NPV) of the expected benefits with the net present value of the expected costs. If the benefits outweigh the costs, then the off-farm investment is made. Formally, the expected NPV of the off-farm investment is specified as:

$$(1) \text{ NPV} = \int_{t=0}^T e^{-rt}(R_t - C_t) dt,$$

where T is the time horizon, r is the discount rate, R_t is the expected net revenue (or returns) associated with the investment, and C_t represents the expected costs associated with the investment. Under a condition of unlimited capital availability, the farmer should undertake any off-farm investment that has a positive NPV. However, this decision becomes

more complicated when risk is taken into consideration.

Now consider a farm operator who has income-generating options in farming and in off-farm investments. In a framework that recognizes risk, the farmer is assumed to maximize the expected value of a von Neumann-Morgenstern utility function subject to an income constraint. In general, utility is a function of income and consumption,

$$(2) U = U(y, c),$$

where y represents net farm income and c is consumption. Farm income may be uncertain for a variety of reasons, but to keep things simple, assume that uncertainty is due solely to price fluctuations. Thus, product price (P) and returns from investments (R) are random in this model. The farm operator's net income (\bar{y}) is then

$$(3) \bar{y} = \bar{P}Q(K, FL) - C(Q) + \bar{R}I,$$

where I is total investment off the farm, Q is total farm output, and output is a function of capital (K) and labor (FL).⁶ In order to derive a richer set of behavioral implications, a specific utility function is defined. Assuming constant absolute risk aversion (CARA) and a joint normal probability density function on \bar{P} and \bar{R} , the farm operator wants to maximize

$$(4) EU(y) =$$

$$E(-e^{-ay}), \text{ or}$$

$$\int_{-\infty}^{\infty} -e^{-a[\bar{P}Q(K, FL) - C(Q) + \bar{R}I]} k e^{-(y - \mu_y)^2 / 2\sigma_y^2} dy,$$

where $dy = QdP + IdR$; $\mu_y = \mu_P + \mu_R$ (μ_P and μ_R are the means of P and R); σ_P^2 and σ_R^2 are the variances; σ_y^2 contains information on σ_P^2 , σ_R^2 , and σ_{PR} ; σ_{PR} is the covariance between P and R ; and $k = 1/\sigma_P \sqrt{2\pi}$. It is well known that maximizing (4) is equivalent to maximizing $\Phi = E(\bar{y}) - (\alpha/2 \times \sigma_y^2)$, where

⁶Note that Q and I are values rather than weights.

α is the Arrow-Pratt degree of absolute risk aversion,

$$(5) E(y) = E(\bar{P})Q - C(Q) + E(\bar{R})I, \text{ and}$$

$$\sigma_y^2 = Q^2\sigma_P^2 + (I)^2\sigma_R^2 + 2QI\sigma_{PR}.$$

The goal of this analysis is to determine the effect of farm and operator characteristics on farmers' decisions to invest in off-farm investment opportunities. An empirical representation of equation (5) that relates off-farm investment to several relevant explanatory variables is given by:

$$(6) Y_i = \mathbf{Z}_i\beta + \psi_i,$$

where $Y_i = 1$ if off-farm investment is made, and 0 otherwise; \mathbf{Z}_i is a vector of farm and operator characteristics; β is a vector of unknown parameters; and ψ_i is a residual error term that is assumed to be normally distributed with zero mean and constant variance. A straightforward logit model was used to analyze the decision to invest or not to invest in off-farm opportunities. The off-farm investment model is specified as:

$$(7) P_i = \frac{1}{1 + e^{-\mathbf{Z}_i}} = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)}},$$

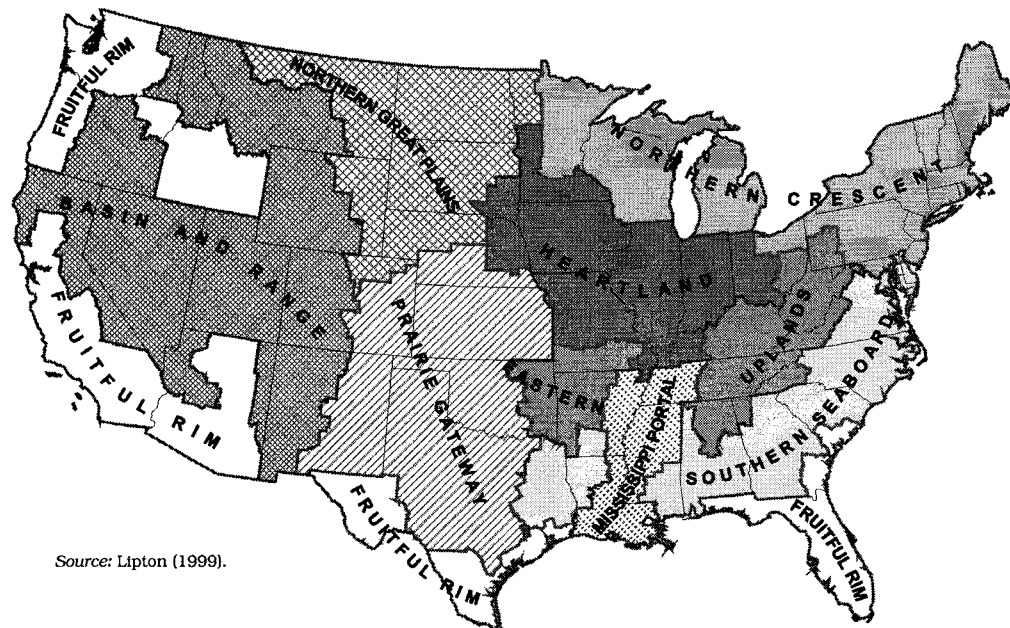
where P_i is the probability that the producer will invest in off-farm opportunities, and \mathbf{Z}_i is a weighted sum of a vector of farm (such as farm size, regional location, debt-to-asset ratio, and farm diversification), operator (i.e., age, education level, management skills, and off-farm work), and household (such as household net worth) characteristics or factors (\mathbf{X}_i) which are hypothesized to influence off-farm investment decisions.

Age (OP_AGE) is hypothesized to have a positive impact on off-farm investment. Young farmers are generally less risk averse and would often be willing to take more risk by investing in risky investments (Young and Barry). Consequently, young farmers are more likely to take advantage of off-farm investment opportunities to increase wealth and expand their

operation. Producers with a higher level of education are more likely to study the complex investment markets (such as stocks, bonds, and mutual funds) and may feel more comfortable with these investments. Therefore, education (OP_EDUC) is expected to have a positive effect on off-farm investment.

Household net worth (HH_NETW) is expected to have a positive impact on off-farm investment. It is assumed that a household/producer with greater equity would have more financial resources to invest off-farm in such assets as stocks, money markets, and mutual funds. Almost 42% of farm households report income from off-farm work ($WORK_OFF$). In this study, farm households that received off-farm income in the form of wages and salaries are considered as working off the farm. Farm households that report off-farm income are expected to have a larger proportion of off-farm assets. This is because many off-farm jobs have incentive savings options in the form of tax-deferred retirement accounts (such as 401K plans) that may be funded in part or in whole by the employer as a portion of the benefits package. Therefore, we expect a positive relationship between off-farm employment ($WORK_OFF$) and off-farm investment. The debt-to-asset ratio ($DEBT_ASSET$) is expected to have a negative effect on the off-farm investment decision by producers—the notion being that higher leverage leaves less money for producers to invest in off-farm opportunities.

The size of farming operation, as indicated by value of production (VAL_PROD), is expected to have a positive effect on off-farm investment. Large-scale operations may have more capital available for off-farm investment than smaller farm operations. The climatic, soil, water, and topographical characteristics of geographic areas constrain the types of crops and livestock that are well adapted. County clusters, based on types of commodities produced, have shown that a few select commodities tend to dominate the



Source: Lipton (1999).

Figure 4. U.S. Farm Resource Regions

production landscape of geographic areas that cut across traditional political boundaries.

To more carefully capture differences among farms and farm households, two classifications of farms have been developed to reflect resource, economic, and demographic attributes of farms and geographic areas (refer to Figure 4 map). The regions used in this study merge information about characteristics of land areas with information about types of commodities produced to generate geographic areas that, while cutting across state boundaries, are more homogeneous with regard to both resource and production activities.

Based on this classification, nine regions were identified, and eight are used in the regression (the Mississippi Portal region was used as the benchmark region). In the 1996 ARMS survey (USDA), 24% of the farms in the sample were located in the Heartland region, followed by Eastern Uplands (18%), and Prairie Gateway (15%). The farms located in the Northern

Crescent comprised 12% of the total sample, and farms in the Southern Seaboard and Fruitful Rim regions were represented equally (10%) in the sample. The remaining 11% of the farms in the sample were located either in the Basin and Range, Northern Great Plains, or Mississippi Portal regions (Figure 4).

Risks are widespread in agriculture and impose additional costs on the farmer (Barry). Farmers will engage in adaptive management activities if they believe they will be compensated for the added costs. Farm diversification (*FM_DIVERS*) is one way to reduce risk. In this study we use an entropy index (i.e., the proportion of revenue from each enterprise in total value of farm production) to measure farm diversification:

FM_DIVERS =

$$\sum_{i=1}^N (\% \text{ production from enterprise } i) \times \frac{\ln \left(\frac{1}{\% \text{ production from enterprise } i} \right)}{\ln(N)},$$

where i refers to each of the N possible enterprises. The index takes a value approaching one when a farm is fully diversified, and zero when a farm is specialized (Theil).

Specifically, an entropy measure of farm diversification considers the number of enterprises in which a farm participates and the relative importance of each enterprise to the farm. An operation with many enterprises, but with one predominant enterprise, would have a lower number on the diversification index. Higher index numbers go to the operations that distribute their production more equally among several enterprises.

A negative relationship is hypothesized between *FM_DIVERS* and off-farm investment.⁷ If producers are using farm diversification as a response to risk, then the likelihood they will invest off the farm is reduced. Additionally, farm diversification may require more capital/resources. Finally, it is our notion that management skills have some effect on off-farm investments. However, the effect of management skill on off-farm investment is unclear. Management skill could have a positive impact on off-farm investment because better managers may be more willing to explore off-farm investment opportunities to reduce income variability. On the other hand, good managers may view agricultural investments as providing higher returns. In this study, farmers who kept written records on income and expenditures are considered better managers (*REC_MGMT*).

Data

Data for the analysis are from the USDA's 1996 "Agricultural Resource Management Study" [(ARMS), formerly known as the

"Farm Costs and Returns Survey" (FCRS)]. The ARMS is conducted annually by the Economic Research Service and the National Agricultural Statistics Service. The survey collects data to measure the financial condition (farm income, expenses, assets, and debts) and operating characteristics of farm businesses, the cost of producing agricultural commodities, and the well-being of farm operator households.

The target population in the survey is operators associated with farm businesses representing agricultural production across the United States. A farm is defined as an establishment that sold or normally would have sold at least \$1,000 of agricultural products during the year. Farms can be organized as proprietorships, partnerships, family corporations, nonfamily corporations, or cooperatives. Data are collected from one operator per farm, the senior farm operator. A senior farm operator is the operator who makes most of the day-to-day management decisions. For the purpose of this study, operator households organized as nonfamily corporations or cooperatives were excluded.

The 1996 ARMS survey collected information on farm households in addition to information collected through the regular survey instrument. It contains detailed information on off-farm hours worked by spouses and farm operators, as well as the amount of money received from off-farm work, net cash income from operating another farm/ranch, net cash income from operating another business, and net income from share renting. Furthermore, income received from other sources such as disability, social security, and unemployment payments, and gross income from interest and dividends is counted. Finally, the survey collected information on farm household expenditures, risk preference measurement, financial difficulties faced by farm households, and use of risk management strategies such as contracting, credit reserves, and futures and options.

⁷ However, as one reviewer pointed out, a positive correlation could exist between diversification and off-farm investment. For example, a producer who chooses to diversify farming (many enterprises) is more likely to diversify his/her total assets (farm and nonfarm assets).

Table 2. Definitions and Summary Statistics of Variables Used in Logit Regression

Variable	Description	Mean	Std. Dev.
Operator/Household Characteristics:			
OP_EDUC	Farm operator's education level (years)	13.00	1.82
OP_AGE	Operator's age (years)	54.26	13.86
WORK_OFF	Off-farm income (=1 if the household receives income from off-farm employment through wages and salaries, 0 otherwise)	0.42	0.49
HH_NETW	Farm household's net worth (includes both farm and nonfarm net worth, \$000s)	525.00	1,054.50
DEBT_ASSET	Debt-to-asset ratio	0.11	4.29
Farm Characteristics:			
VAL_PROD	Value of agricultural production sold by the farm (\$000s)	79.35	231.00
FM_DIVERS	Entropy measure of farm diversification	0.15	0.14
REC_MGMT	Management indicator (=1 if the farm kept records on income and expenditures, 0 otherwise)	0.49	0.50
Regions:			
H_LAND	=1 if the farm is located in the Heartland region, 0 otherwise	0.24	8.75
N_CRESCENT	=1 if the farm is located in the Northern Crescent region, 0 otherwise	0.12	5.65
N_GREATP	=1 if the farm is located in the Northern Great Plains region, 0 otherwise	0.02	2.58
P_GATE	=1 if the farm is located in the Prairie Gateway region, 0 otherwise	0.15	6.08
E_UPLAND	=1 if the farm is located in the Eastern Upland region, 0 otherwise	0.18	6.58
S_SBOARD	=1 if the farm is located in the Southern Seaboard region, 0 otherwise	0.10	5.59
F_RIM	=1 if the farm is located in the Fruitful Rim region, 0 otherwise	0.10	5.65
B_RANGE	=1 if the farm is located in the Basin and Range region, 0 otherwise	0.08	4.44
OF_INVEST	Farm household investment in off-farm opportunities (=1 if the household received interest payments and dividends, 0 otherwise)	0.61	0.49
SAMPLE SIZE = 3,993			

Source: 1996 "Agricultural Resource Management Study" (ARMS), USDA.

Summary statistics for each of the variables utilized in our analysis are presented in Table 2. Approximately 61% of the farm households received interest payments and dividends from off-farm investments (*OF_INVEST*). The average age (*OP_AGE*) of the senior farm operator in the household was 54 years, with 13 years of education (*OP_EDUC*). Forty-two percent of farm households reported off-farm income (*WORK_OFF*), with average earnings of \$26,100. The average household reported a net worth of

\$525,000 (*HH_NETW*), with \$107,780 in nonfarm assets. The 1996 ARMS data show average total household income was \$47,129, and average gross farm income was \$75,800. Finally, 49% of the producers reported keeping written records (general ledger and personal income record) of income and expenditures on farming operations (*REC_MGMT*).

The ARMS survey also collected information on off-farm investment activities. Operators were asked if they

received interest payments and dividends. The dependent variable (*OF_INVEST*) is constructed keeping in mind that the present study is investigating the effect of various farm, operator, and regional characteristics on the likelihood of off-farm investment. Therefore, *OF_INVEST* takes a value of one if the household received interest payments and dividends, and zero otherwise.

Results

Results of the estimated logit model [equation (7)], significance tests, changes in probability (estimated at the mean), goodness-of-fit measure, and in-sample prediction for the probability of off-farm investment by farm households are presented in Table 3. The log-likelihood ratio (LR) χ^2 statistic (-2LogL), which tests the joint significance of the independent variables included in the model, is significant at the 1% level.

The coefficients of operator's education (*OP_EDUC*) and age (*OP_AGE*) have the expected sign and are statistically significant at the 1% level. Results suggest that producers with a higher level of education are more likely to invest in off-farm opportunities. The marginal effect (= 0.030) indicates that an additional year of schooling would increase the likelihood of off-farm investment by 3%. Results also indicate that the impact of age on off-farm investment is positive and significant at the 1% level. The marginal effect (= 0.059) suggests that an additional year of age would increase the likelihood of off-farm investment by approximately 6%. On the other hand, the coefficient on *AGE_SQE* is negative and statistically significant at the 1% level. The negative coefficient implies an inverted-U shape in the age-investment profile for farm operators.

A further line of explanation comes from the patterns of income and wealth associated with the life cycle (Gasson et al.; Ahearn, Perry, and El-Osta; Hill). Our finding is consistent with theory.

As expected, farm households reporting off-farm income (*WORK_OFF*) are more likely to invest off the farm. The marginal effect (= 0.020) indicates that households with off-farm income are much more likely to invest in off-farm opportunities, *ceteris paribus*. One factor which possibly explains this behavior is that many off-farm jobs have some fringe benefits, thus providing incentives for investments in options like 401K plans, IRAs, and other tax-deferred savings plans.

The coefficients on household net worth (*HH_NETW*) and value of agricultural production (*VAL_PROD*), a proxy for farm size, are positive and statistically significant at the 5% and 1% levels, respectively. However, their marginal effects are very small. These findings show that households with more equity are more likely to invest off the farm. Likewise, larger farms are more likely to invest off the farm.

The coefficient of the debt-to-asset ratio (*DEBT_ASSET*) is negative and statistically significant at the 1% level, suggesting that as debt level increases, the likelihood of investing off the farm decreases. The relatively large marginal effect (= 0.197) reveals that producers who have low leverage are more likely to invest off the farm, *ceteris paribus*. One explanation could be that producers with higher levels of debt may choose to retire debt instead of investing off the farm. In contrast, farm operators with low debt levels are more likely to invest in off-farm opportunities.

Farm diversification is one way to spread risk and stabilize income. The coefficient for farm diversification (*FM_DIVERS*) is negative and statistically significant at the 1% level. Thus, producers who spread risk through farm diversification are less likely to invest off the farm. The marginal effect (= -0.041) indicates that farmers who diversify in farming operations (i.e., farm diversification) are less likely to invest in off-farm opportunities, *ceteris paribus*. This is in accordance with the fact that if the producer uses funds to diversify the

Table 3. Logit Regression Results for Off-Farm Investment Decisions by Farm Households

Explanatory Variable	Parameter Estimate (Std. Error)	Change in Probability	Explanatory Variable	Parameter Estimate (Std. Error)	Change in Probability
Intercept	-3.179*** (0.027)	—	REC_MGMT	0.397*** (0.004)	0.098
OP_EDUC	0.128*** (0.001)	0.030	H_LAND	-0.363*** (0.110)	-0.090
OP_AGE	0.025*** (0.001)	0.059	N_CRESCENT	0.029 (0.124)	0.007
AGE_SQE	-0.0001*** (0.008) $\times 10^{-4}$	0.0002	N_GREATP	-0.324** (0.174)	-0.081
WORK_OFF	0.082*** (0.004)	0.020	P_GATE	0.635*** (0.006)	0.159
HH_NETW	0.001** (0.0006) $\times 10^{-4}$	0.0002	E_UPLAND	0.119 (0.128)	0.030
DEBT_ASSET	-0.788*** (0.155)	0.197	S_SBOARD	0.216* (0.118)	0.054
VAL_PROD	0.0002*** (0.00002)	0.0001	F_RIM	-0.231 (0.146)	-0.058
FM_DIVERS	-0.174*** (0.012)	-0.041	B_RANGE	-0.214*** (0.009)	-0.054
Log-Likelihood Ratio (LR) = [-2LogL]: 261.27***					
Correct Predictions (%): 65.80					

Notes: Single, double, and triple asterisks (*) denote statistical significance at the 10%, 5%, and 1% levels, respectively. Numbers in parentheses are standard errors.

farming operation, there is less likelihood a producer will have funds available for off-farm investment.

The coefficient for management skills (REC_MGMT) is positive and statistically significant at the 1% level. As implied by the marginal effect (= 0.098), better managers are much more likely to invest in off-farm opportunities, ceteris paribus. This finding supports the notion that better producers/managers who keep track of their income and expenditures from farming operations have better control of their money/funds. Further, in order to reduce income variability, better managers are more willing to study off-farm investment opportunities.

Finally, results from Table 3 show regional differences in off-farm investment behavior. Farm households located in the Heartland, Northern Great Plains, and

Basin and Range regions are less likely to invest off the farm when compared to the Mississippi Portal region (our benchmark). A possible reason for this finding is that farms in the Heartland, Northern Great Plains, and Basin and Range regions are larger and have higher debt-to-asset ratios compared to farms in the benchmark Mississippi Portal region where farms are smaller and carry less debt. Conversely, farm households located in the Prairie Gateway and Southern Seaboard are more likely to invest in off-farm opportunities when compared to the benchmark Mississippi Portal region.

Conclusions

The purpose of this study was to investigate factors that affect off-farm investment by farm households. A logit analysis was performed on the data from

the 1996 ARMS survey to analyze the effect of various farm, operator, and regional characteristics on off-farm investment decisions by farm households.

Operator's level of education and age had expected positive signs and were significant in explaining off-farm investment decisions. Household net worth, farm size, and off-farm involvement had the expected positive effects on off-farm investment. In the case of farm size, results suggest that large farms are more likely to be financially diversified than small farms. Increased farm diversification and higher debt reduced the likelihood of off-farm investment by farm households. Better managers are more likely to invest off the farm.

Finally, farm households located in the Heartland, Northern Great Plains, and Basin and Range regions are less likely to invest in off-farm opportunities. In contrast, farm households located in the Prairie Gateway and Southern Seaboard are more likely to invest off the farm.

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